

### **REMARKS**

In order to facilitate prosecution, Applicants have amended claims 1, 11 and 12 to correct minor typographical errors. Support is found the specification and claims as originally filed. No new matter has been added.

#### **Response to Rejections Under 35 U.S.C. §§ 102(e)/103(a)**

The Examiner rejects claims 1-16 under 35 U.S.C. §§ 102(e)/103(a) as being anticipated or in the alternative obvious over U.S. Patent Publication No. 2002/0150532 (Grieve) and U.S. Patent No. 6,436,363 (Hwang). Applicants respectfully traverse this rejection.

As the Examiner acknowledges, the filing date of Grieve is February 15, 2001, and Hwang is August 31, 2000, which is after Applicant's foreign priority date of May 20, 2000 (office Action, p.3). Applicants enclose a copy of the certified English translation of Applicant's priority document-- German patent application No. 100 25 032.7. Applicants submit that the priority document is substantially the same as the present application. Accordingly, Grieve and Hwang are not available as prior art and Applicant's respectfully submit that the rejection should be withdrawn.

#### **Response to First Rejection Under 35 U.S.C. § 103(a)**

Claims 1-6 and 10 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,524,550 (Chintawar) and U.S. Patent No. 6,342,465 (Klein). Applicants respectfully traverse this rejection.

The Examiner asserts that Chintawar discloses an adiabatic reforming process using a catalyst that contains platinum or rhodium, on a support material such as titanium dioxide. The Examiner acknowledges that Chintawar does not disclose that the catalytic material is applied as a coating, but uses Klein for disclosing a catalytically active material obtained from a dispersion that is coated

on the carrier. The Examiner combines the cited references and concludes that the present claims are obvious. Applicants respectfully traverse this rejection.

To establish a *prima facie* case of obviousness, all of the claim elements must be taught or suggested by the prior art. *In re Vaack*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir.1991). Chintawar is directed primarily to catalysts used in a water gas shift reaction and a catalyst for use in such process. See summary of invention col. 4, lines: 64-67:

According to another aspect of the invention, a water gas shift reaction can be accomplished in a reformat over a wide range of temperatures (for example, between about 200°C. to about 650°C) using a single shift catalyst.

While Chintawar may mention steam reforming, Chintawar does not disclose, teach or suggest a process for autothermal catalytic steam reforming of hydrocarbons by: a) preheating a reactant mixture containing hydrocarbons, oxygen and water and then b) passing the preheated mixture over the catalyst that is operated adiabatically—without the removal or addition of heat.

In contrast, the present invention claims a process for autothermal catalytic steam reforming of hydrocarbons. The claimed process involves preheating a reactant mixture of hydrocarbons, oxygen and water or water vapor, this preheated mixture is passed over the catalyst adiabatically--without the removal or addition of heat. Accordingly, Chintawar does not disclose, teach or suggest every element of the claimed invention.

Moreover, the catalysts used in the autothermal catalytic steam reforming process of the present invention has a coating of catalyst material containing the platinum group metal fixed on the oxidic support material. This is different from

the catalyst of Chintawar that is produced by "the incipient wetness" impregnation method (col. 6, line 39). The Examiner acknowledges this in the Office Action (p.4). Thus, not only is the claimed method not disclosed in Chintawar, but also the presently claimed catalyst used in the autothermal catalytic steam reforming process not disclosed, taught or suggested in Chintawar.

Klein discloses a process for preparing a catalyst that has a high catalytically active coating, which is used for cleaning automotive exhaust gases. See, example 1, and columns 9-10. Klein teaches the use of anionic salts of platinum group metals for pore volume impregnation. Klein does not disclose, teach or suggest a catalyst useful in an autothermal reforming process, where a preheated reactant mixture of hydrocarbons, oxygen and water or water vapor, is passed over the catalyst adiabatically. In fact, Klein does not mention autothermal steam reforming at all.

Since Chintawar nor Klein disclose, teach or suggest the present claims that include preheating the reactant mixture and passing it over catalyst adiabatically, the present claims cannot be considered obvious. Moreover, one of ordinary skill in the art would not combine these two references together to obtain the present claims, since Chintawar is directed to a shift catalyst and Klien does not disclose autothermal reforming processes. Accordingly, there is no motivation to combine the references in such a way to obtain the claimed invention. Therefore, it is respectfully submitted that an obvious rejection under 35 U.S.C. §103 is improper. Applicants request withdrawal of this rejection.

**Response to Second Rejection Under 35 U.S.C. § 103(a)**

Claims 7-9 and 11-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Chintawar and Klein and either Choudhary U.S. Patent No.

6,293,979 or Fujitani U.S. Patent No. 4,367,166. Applicants respectfully traverse this rejection.

The Examiner asserts that Chintawar discloses an adiabatic reforming process using a catalyst that contains platinum or rhodium, on a support material such as titanium dioxide and that Klein discloses a catalyst having a catalytically active material obtained from a dispersion that is coated on the carrier. The Examiner asserts that Choudhary discloses that cerium is useful for adiabatic reforming and that Fujitani discloses that cerium oxide is a suitable component of the catalyst of Chintawar. The Examiner concludes that the present claims are obvious over the cited references. Applicants respectfully traverse this rejection.

As stated above, neither Chintawar nor Klein disclose, teach or suggest an autothermal process or a catalyst for use in the process that involves preheating a reactant mixture containing hydrocarbons, oxygen and water and then b) passing the preheated mixture over the catalyst that is operated adiabatically.

With regard to Choudhary, this reference discloses a process for methane or natural gas conversion using improved supported catalysts containing oxides of nickel and cobalt with or without precious metals. See summary of invention col. 4, lines: 53-59:

This invention provides a catalytic process for conversion of methane or natural gas to syngas or a mixture of carbon monoxide and hydrogen in a most energy efficient manner in a fixed bed adiabatic or non-adiabatic reactor using an improved supported catalyst containing oxides of nickel and cobalt, with or without noble metals.

Choudhary does not deal with autothermal catalytic steam reforming of hydrocarbons in fuel cells, but in a fixed bed reactor. Moreover, the catalyst disclosed in Choudhary contains oxides of nickel and cobalt, which are not the

claimed oxidic support materials of aluminum oxide, silicon dioxide, titanium dioxide or mixed oxides thereof or zeolites as presently claimed.

Further, Choudhary discloses that cerium (chemical formula = Ce) in the elemental state as the metal in combination with other metals such as Pt, Rh, Ir, Ru, *etc.* (col. 1, lines 41-50). Choudhary does not disclose cerium oxide ("ceria," chemical formula =  $\text{Ce}_2\text{O}_3$  and/or  $\text{CeO}_2$ ) as recited in pending claims 7 and 8.

Fujitani discloses a catalyst for conventional steam reforming, consisting of cerium oxide and rhodium. The support material is a conventional pellet carrier or a porous body, which is impregnated with cerium nitrate and rhodium nitrate and then calcined (example 1). Fujitani clearly does not disclose, teach or suggest an autothermal process or a catalyst for use in the process that involves preheating a reactant mixture containing hydrocarbons, oxygen and water and then passing the preheated mixture over the catalyst that is operated adiabatically. Moreover, Fujitani does not disclose, teach or suggest the claimed oxidic support material selected from the group consisting of aluminum oxide, silicon dioxide, titanium dioxide or mixed oxides thereof or zeolites.

Since none of the cited references disclose, teach or suggest the present claims that include preheating the reactant mixture and passing it over catalyst adiabatically, and the claimed catalyst is not disclosed in the cited references, then the present claims cannot be considered obvious. Moreover, there is no motivation to combine the references in such a way to obtain the claimed invention. Therefore, it is respectfully submitted that an obvious rejection under 35 U.S.C. §103(a) is improper. Applicants request withdrawal of this rejection.


**Conclusion**

All of the stated grounds of the rejections, it is respectfully submitted, have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. Applicants believe that the present application is in condition for Allowance. Entry of amendment, and reconsideration of the application is respectfully requested.

If any additional fees are due, or an overpayment has been made, please charge, or credit, our Deposit Account No. 11-0171 for such sum.

If a telephone conference would be of assistance in furthering the prosecution of the application, Applicants' undersigned attorney requests that she be contacted at the telephone number provided below.

Respectfully submitted,



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